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SKULL MEASUREMENTS IN THE NORTHERN VIRGINIA DEER

By John C. Phillips

Several years ago it occurred to me that a large series of measurements of skulls of a selected species from a restricted area might be of general interest. In the first place, if the figures were carefully tabulated and subjected to a biometric analysis they might point out the relative values of the different skull measurements. By "relative" value I mean value to the systematist, as shown by their constancy (lack of variability). By working with sufficiently large series, it seemed that the coefficients of variability of the different skull measurements might be compared directly, one with another, and thus subjected to the acid test.

Another question was that of the maximum and minimum variation within the race or subspecies, a study of which might form a basis for comparison with other races.

It was also thought that in taking a large mammal, the actual technique of measurement was subject to less error, and as the northern Virginia deer (*Odocoileus virginianus borealis*) was the only large species available in any numbers, it was accordingly chosen.

Special care was taken to throw out any specimens that were not fully adult, and after measuring 109 skulls of males, 13 of them, having an antler length of 38 cm. or under, were discarded, as being perhaps not fully developed. The remaining 96 specimens represent, in my opinion, a selected class of adult males with antlers between 38 cm., and 72.5 cm., and an average of 47.6 cm. The type of *O. v. borealis* in the Museum of Comparative Zoology has antlers 66 cm. long. A series of skulls of females was not available.

All these deer heads came into the taxidermist shop of Mr. M. Abbott Fraser of Boston, and they were nearly all secured in the Boston market, being picked out because of their value for ornamental purposes. Practically all came from northern and eastern Maine, and possibly one or two from northern New Hampshire and Vermont. (One I am certain was from Vermont.) I am indebted to Mr. Fraser for placing this material at my disposal.

It is probable that these animals are four years old, or older, and a few showed by their worn teeth that they had about reached the extreme age limit.

A word of explanation is necessary in regard to the way the various measurements were taken.

1. Palatal length. (From back of posterior molar to gnathion.)
2. Audito-basal length. Owing to the fact that the posterior end of many of these skulls was damaged in the taxidermist shop, in process of getting out the brains, the condylion could not be utilized in taking the condylo-basal length. Accordingly I selected the anterior edge of the auditory canal as the posterior point and the gnathion as the anterior point, calling this the audito-basal length.
3. The length of lower tooth row.
4. The zygomatic width (greatest width outside zygomata).
5. The length of upper tooth row.
6. The greatest width of orbit.
7. The mastoid width (greatest width between mastoid prominences).
8. Length of nasal bones.
9. The length of antler along outer curve.

The probable error is also given in each case for the mean, the standard deviation, and the coefficient of variability.

A summary of all these measurements is given below in the form of a table, the measurements appearing in the order of their uniformity, those having the smallest coefficient of variability (C. V.) appearing first.

Under each measurement appears:

1. The number of individuals upon which the calculation is based.
2. The actual mean size of the whole series.
3. The absolute maximum size.
4. The absolute minimum size.
5. Measurement of the type of *borealis* in Museum of Comparative Zoology.
6. The standard deviation, or index of variability (see Davenport, Statistical Methods, John Wiley & Son, 1899, page 15) which gives the average deviation of all individuals from the mean.
7. The coefficient of variability (see Davenport) wherein the deviations from the mean of all the different individuals are reduced to a concrete number, which renders the different skull measurement directly comparable, one with another. This is the important figure to note, and the only one of special interest in determining the relative value for systematic purposes of the various measurements here studied.

	NUMBER OF INDIVIDUALS	MEAN SIZE	MAXIMUM SIZE	MINIMUM SIZE	SIZE OF THE TYPE IN MUS. COMP. ZOOL.	STANDARD DEVIATION, σ	COEFFICIENT OF VARIABILITY, C. V.
Palatal length	92	17.6 ±0.05	19.4	15.5	19.0	0.76 ±0.04	4.318 ±0.21
Audito-basal length	91	26.65 ±0.08	30.2	23.7	28.5	1.21 ±0.06	4.55 ±0.23
Lower tooth row, length	95	8.31 ±0.03	9.2	7.1	8.2	0.414 ±0.02	4.97 ±0.24
Zygomatic width	96	11.76 ±0.04	13.4	10.4	13.4	0.6 ±0.03	5.107 ±0.24
Upper tooth row, length	96	7.62 ±0.03	8.5	6.0	7.8	0.41 ±0.02	5.39 ±0.26
Orbit width	96	4.27 ±0.02	4.9	3.8	4.0	0.24 ±0.01	5.6 ±0.27
Mastoid width	95	9.83 ±0.05	12.0	8.4	10.3	0.696 ±.034	7.102 ±.348
Nasals, length	94	9.0 ±0.06	10.9	6.1	9.1	0.89 ±0.04	9.9 ±0.5
Antler length of adults	95	49.8 ±0.47	72.5	38.2	66.0	6.87 ±0.34	13.78 ±0.89
Antler length including 13 juveniles	108	47.6 ±0.57	72.5	21.0	66.0	8.9 ±0.4	18.66 ±1.41

Note.—All measurements in Cms.

DISCUSSION

As may be seen at a glance, the most reliable skull measurement in this species, perhaps also in the deer family generally, is the palatal length, which shows a coefficient of variability (C. V.) of only 4.318. Next, and very nearly as uniform, is the audito-basal length (explained above) with a C. V. of only 4.55. The lower tooth row is less variable than the upper, but both these and the zygomatic width are substantially of the same value and are all very uniform.

The orbit width (greatest width of orbit) is also a reliable measurement, but when we come to mastoid width, there is a very marked difference. It is possible that this C. V. (7.102) may have been slightly effected by damaged mastoids, although all those skulls which appeared to have been chipped or injured in the mastoid region were thrown out.

The nasal bones are, as might be expected, by far the least valuable character, showing nearly double the variation of the palatal length. The antler length is included merely to give an idea of the size of the individuals, and naturally shows a very great range of variation. With the 13 juveniles included (these were not included in any of the other measurements) the antler length is of course still more variable.

The value, if value there is, in this study of a series of deer skulls, lies in the fact that all specimens come from a fairly well restricted locality, and that they were all measured by myself in the same way and with the same instruments. I wish that the number of specimens could have been still greater, but as it is, it appears large enough to give a fairly reliable answer to the question of the variability of the several measurements in adult males of the northern Virginia deer. It also gives a correct idea of the extremes of size which we may expect to find in this race.